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TECHNOLOGY POLICY TASK FORCE HEARING SUMMARY

REVIEW OF PREVIOUS STUDIES

REPORT

PREPARED FOR THE

TECHNOLOGY POLICY TASK FORCE

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COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY
U.S. HOUSE OF REPRESENTATIVES
WASHINGTON, D.C.

TECHNOLOGY POLICY TASK FORCE

HEARING SUMMARY

ON

REVIEW OF PREVIOUS STUDIES

June 3, 1987

Prepared by

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Principal Investigator, Technology Policy Task Force

I. Introduction

On April 23, 1987 the Committee on Science, Space, and Technology formally formed a Task Force to study technology policy.

Over the past decade numerous reports have been written, documenting the decline of U.S. competitiveness and technological capability which provided recommendations for change.

Three major studies dealing with the full spectra of issues on U.S. competitiveness were reviewed by the Task Force.

The Report of the President's Commission on Industrial Competitiveness; Global Competition: The New Reality, issued January, 1985.

Reports by the Business-Higher Education Forum; including: An Action Agenda for America Competitiveness, issued September 1986.

Reports and studies by the National Academy of Engineering; including: Industrial Innovation and Public Policy Options, issued 1980.

This report presents a summary of the highlights of the hearing.

Purpose of the Hearing

The hearing was held to obtain an overview of previous major studies which have considered various aspects of technology policy and which included recommendations. For this purpose the Task Force selected recent studies performed by the private sector, a Presidential Commission and the National Academy of Engineering.

Another object of the hearing was to obtain the current status of the recommendations of the three studies, and determine if new or existing issues need attention from Congress in order to improve the Nation's technological capabilities.

Participants

Witnesses

Edward Donley
Chairman, Executive Committee Air Products and Chemical, Inc.
Chairman, Business-Higher Education Forum

Alexander Flax
Home Secretary, National Academy of Engineering

Egils Milbergs
Assistant to Director, Center for Innovative Technologies
Former Executive Director, President's Commission on Industrial Competitiveness

Advisory Board

Dale Compton
National Academy of Engineering

Chris Hill
Congressional Research Service

Robert Rosenzweig
President, Association of American Universities

Karl Willenbrock
Executive Director
American Society of Engineering Education

II. Conclusions

The United States must now compete in a global market and must quickly learn to adjust to that fact. This was one of the main messages heard at the hearing. However, the nation has been aroused through the various studies and reports describing the decline in competitiveness, and is now beginning to make progress. But, according to the witnesses, there is a long way to go, and constant attention to the issues are needed for the future. One of the primary roles of the Federal Government therefore is the responsibility to provide the "climate" and incentives for industry to improve the rate at which technologies are developed and transformed into marketable products.

One of the major problems was seen as the lack of ability of U.S. industry to take advantage of the results of R&D development not only in the U.S., but also abroad. A gap exists between research and technology development and commercialization. Reasons for this are: the economic climate, the effect of government policies, insufficient attention to the educational system, and decline in manufacturing research and technology. Based on their studies, the witnesses suggested various methods to strengthen the ability of the U.S. to produce competitive products.

These suggestions included, adjustments in macro-economic policies, restructuring the Federal Government to more effectively administer science and technology, cooperation from State and local government in competitiveness initiatives, and closer coupling of the university research capability and industry.

There was a perception of a corporate culture with short term orientation and adversity to risk taking among U.S. firms. This also influenced the conversion of science to commercial products. This attitude was in part a result of the high cost of capital and labor in the U.S. compared to its major competitors, particularly Japan. Therefore, more attention should be given to solve these problems.

Government policies affect the economic and financial environment in the nation, and therefore will determine private sector decisions on investment in technologies. In order to assure that the industrial sector is not adversely affected by these policies, it was suggested that all bills that come before the Federal, State, and local governments should be subjected to a competitive impact analysis.

Cooperation among industrial firms can only come through industry leadership and the recognition that there can be benefits in cooperation. However, the Task Force also heard that antitrust laws had created barriers for such cooperation and has resulted in a "mind-set" among industry managers that would take time to change.

Restructuring of the Federal Government to provide a better focus for science and technology issues was a major element in the discussion. There was broad agreement that science and technology should be given more credence in the Executive Branch. It was also suggested that Congress should look at its organization and how it deals with science and technology issues. The President's Commission on Industrial Competitiveness made a recommendation for the creation of a Department of Science

and Technology. This recommendation received little support among the participants during the debate following the initial testimony. Questions were raised as to the role of such a Department. What should it accomplish? Would it be desireable to concentrate all Federal R&D in one single agency? From what other agencies would the R&D programs be taken? It was suggested that recent past experiences with restructuring did not provide a good model. Alternatives to such a major restructuring were to strengthen the Department of Commerce, and the Office of Science and Technology Policy (OSTP). According to the witnesses, OSTP can not be effective unless the President recognizes the organization and has the will to use it. The Task Force was urged to consider a Cabinet-level representation for science and technology.

The pluralism in the process of innovation in the U.S. was seen as a major strength, with innovation taking place in Federal laboratories, large corporations, small business ventures and at the State and local levels.

Experimentation with competitiveness initiatives and technology transfer are now underway in the State and local governments. According to witnesses, these should be supported by the Federal Government. Initiatives such as the Ben Franklin superconductivity initiative in Pennsylvania and a number of initiatives in Virginia, were targeting specific issues.

There is a need to more closely couple university and industry efforts. The engineering research centers created by the National Science Foundation (NSF) go a long way, but other mechanisms should not be excluded.

Insufficient attention had been given to manufacturing over many years. Both industry and universities needed to pay more attention to this important discipline.

There was broad agreement among the participants that innovation and competitiveness of the industry are vital on a global scale to the well-being of the nation. The policy question will be how to encourage and promote innovation and competitiveness and particularly the role the government should have in that process.

III. Discussion

General

In his opening remarks, Chairman MacKay emphasized the importance of getting the perspective of those who have conducted other studies to learn from their experience. "...it's important that we start out not by reinventing the wheel, but by indicating that we understand that there have been numerous studies already in this area... ."

There was general agreement that the decline in U.S. industrial innovation was not recent. Dr. Alexander Flax, Home Secretary, NAE stated "It [U.S. industrial innovation] had been a world leader. It had served us well for 100 years. But it didn't meet the competitive challenges which were arising abroad." Dr. Flax defined innovation as "the mechanism by which technology is successfully applied in industry to produce new products, processes and services." Innovation does not always depend on the latest technology. Innovation should stem from the technology that makes the most sense. "We often think that if we just have the cutting edge of technology available to us, that will solve all our problems." he stated.

"Our economy is undergoing vast structural changes, being caused principally by the worldwide technology explosion and by global competition", according to Mr. Egils Milbergs, former Executive Director of the President's Commission on Industrial Competitiveness, the "Young Commission". As a result, one of the most critical challenges we face is the relationship of technology and innovation to America's long-term economic competitive future in the world market, said Mr. Edward Donley, Chairman of the Business-Higher Education Forum and Chairman of the Executive Committee of Air Products and Chemicals, Inc. "The central recommendations of the Forum study was that our society must develop a consensus that industrial competitiveness on a global scale is crucial to our social and economic well-being."

The President's Commission pointed out that the solution to our competitiveness problem should be to "focus on our own internal assets", rather than concentrate on "the external threat of global competition". Mr. Milbergs stated that the current debate on competitiveness put the burden on foreign competitors to adjust, and that for too long we have been attacking the problem outside our own boundaries, by studying unfair trade practice, low wages in other countries, and unfavorable exchange rates. Technology is rapidly being developed worldwide and the U.S. does not have a monopoly on competitively useful technology, he continued. To enhance our competitive potential, the nation should develop an offensive strategy based on two of America's advantages, its technological base and its talent. "We need to create a technological gap, one in our favor," said Mr. Milbergs. Dr. Flax did not see a permanent solution to the

problems. "It is a race in which we must constantly keep in the forefront." Without constant attention to the rapidly changing picture of the world-wide availability of technologies we will not be able to solve our problems. Technology flows easily across international borders, and there are no feasible means to bar this flow from our borders even if we want to, Dr. Flax commented.

Dr. Flax also maintained that "we have to use our technology to do things our way and not give up gains that we have gathered over many, many years in our standard of living or in the quality of life for our people."

In the National Academy of Engineering (NAE) panels, there were broad agreements on the need to constantly find ways to encourage and promote innovation and technical progress in industry, commented Dr. Flax, "but the debate, as well as the differences among panel members, was on how to encourage and promote innovation and on the role the government should have in that process. "So there is an area, really, which poses some very important policy questions," he said. Mr. Milbergs said that there were those who argued that there was no need to do anything but make adjustments in macro-economic policy, and those who wanted an aggressive intervention by the Government. "I believe there is another alternative available, which is to emphasize competitive initiatives already underway and improve the coordination of existing policies and programs."

Competitiveness of U.S. Industry

From his personal involvement in American business, Mr. Donley stated

that the U.S. is becoming more competitive than it was five years ago. "Five years ago," he said, we had about one percent of what was needed to make American industry competitive in world markets. Today that has increased an order of magnitude to about ten percent. ...So, although the progress has been remarkably good, we have a long, long way to go. But most important, the nation has been aroused, and tremendous progress has been made." As an example of this, Mr. Donley cited the experience at Air Products, where productivity increased in the range of 35 percent over the last five years. "And we did it by the application of new technology, meaning primarily computer hardware, software, robots and so forth." He also found that similar accomplishments had been made across the country. Dr. Flax concurred with Mr. Donley that progress was being made, and also that we still have a long way to go in many areas. The NAE studies illustrated a need to see mechanisms which are consistent with our own political, social and economic system to deal with the many interacting factors in a coherent way. The way in which organizations and management use technology is equally important. Also important is the way management and labor interact and focus on the use of technology.

Mr. Milbergs said that technology is our greatest asset in world competition. The U.S. spends more on research and development than the western world countries combined. Mr. Milbergs said: "..., but we are not able to capture the downstream economic benefits. We are not being out-invented or out-created, we are being out-manufactured and out-produced." Dr. Flax said that the U.S. is not behind in science and technology. In

these fields the U.S. leads the world. "What we are talking about is industrial application.... So, the mechanism we want to look for are the mechanism that reach successful industrial application..."

"There clearly is a problem in how you move from initial technical feasibility demonstrated in the university, or a Federal laboratory, for that matter, to beginning the commercialization process in the private sector, where private capital is essentially financing the rest of it. There is a gap there", according to Mr. Milbergs.

Congressman Fawell asked if the corporate culture in the U.S. "...is inhibiting our ability to take what we have got and to be able to be truly competitive, in long-term risk and low profit concept." American industry has been accused of having fixation on quarterly returns, protection against raiders and Wall Street," he said. This has made industry adverse to taking risks and "using all the innovativeness and individualism which is a hallmark we like to think of America,--we find that increasingly the converse is true insofar as our commercialization." Mr. Donley agreed that American business management has a short term orientation in comparison to our competitors, but this was changing rapidly due to the internationalization of the financial and investment markets, which are more open than commodity and product markets. There are other impediments, beside the corporate structure, to efficient commercialization. One of the factors which affect the rate of commercialization is the cost of both labor and capital. "So, if you are a Japanese manager, you can throw capital and human resources onto rapid commercialization at lower cost than you can in the United States, and those are the factors that I

think we ought to direct our national attention to." Dr. Flax stated that the culture "we are talking about" is much more than just the corporate culture. It is our national culture. We have to adapt to the fact that we are engaged in international competition. Mr. Milbergs offered that one of the cultural changes we need to make is an old one and this the "not invented here." "We need to realize there are good ideas emerging around the world and to bring them over here."

Dr. Dale Compton, Senior Fellow NAE, and a member of the Task Force Advisory Board stated that American industry historically has viewed its main competitors as other U.S. companies, something which has been mainly due to the very large size of the U.S. market itself. It has not viewed itself as collectively competing worldwide.

Dr. Flax stressed that the U.S. industry needed to pay attention to the rapidly changing picture of the availability of technology both abroad and within the U.S. in order to solve its problem.

Impact of Government Policies

The various aspects of government policy have an effect on the national economic and financial environment, said Dr. Flax, and this will determine where new technology may be applied most productively. These policies included fiscal policy, monetary policy, tax policy, antitrust policy, trade policy, patent policy and other regulatory policies.

The 99th Congress passed the most far-reaching tax bill in this century.

From the standpoint of the industrial sector, and particularly the so-called industrial rust belt part of the American economy, that tax bill was adverse to enhancing the competitive position of U.S. industry, according to Mr. Donley. Among the adverse factors, he listed the increased cost of capital, "...which was already higher by nearly two to one than it is in Japan and Western Europe...", the increased cost of after-tax research and development, and the increased cost of capital gains "...was adverse to entrepreneurship in this country, and that is, adverse to competitiveness and to the job machine that we have in this country represented by the new small entrepreneurial company".

Congressman Packard asked what effect reducing the tax incentives for R&D would have on industry and their productiveness. Mr. Donley answered that in his best judgement, of the factors he mentioned, the increase in cost of capital would rank as number one, with a nine on a scale from 1 to 10. This factor changes the depreciation schedule. He would give the change in the capital gains tax a seven, and the R&D tax credit would be a three.

To reduce the cost of capital was one of the Commission's major recommendations. Mr. Milbergs stated that [in the new tax law] the R&D tax credit was extended, but the incentive was reduced from 25 percent to 20 percent, was not made permanent and the definition for what qualified as R&D was not broadened, contrary to the Commission's recommendation.

Mr. Donley also listed a number of other issues that will be brought before the 100th Congress which will have significant effect on the competitiveness of U.S. business. One major issue was liability insurance and tort reform legislation. Mr. Donley gave the example of his company which pays $2000 per year for health care for each employee. Of the $2000, $700 is attributable to malpractice insurance paid by hospitals, doctors and drug companies. Of the 21 countries in the world where Air Products has investments, only Great Britain at one-fifth the cost, comes close the the U.S. for comparable insurance.

This and several other issues such as doublebreasting, mandated health care, and plant closing control would further adversely affect the competitiveness of U.S. industry if passed in their contemplated form, Mr. Donley stated. He urged Congress to consider the impact of such legislation on the country's competitiveness, as is done by other nations in every element of their society. "And if it doesn't have an affirmative answer, then it will inevitably adversely affect job creation and prosperity in this country for the future." Mr. Donley called for a competitiveness impact statement for "...every regulation, every law, every bill that comes before the Federal, State and local governments...." This was also echoed by Congressman Ritter. "We have a package of bills coming, -- which are about absolutely guaranteed to increase the cost of doing business in the United States of America at some rather substantial level. ...Is all this legislation that is coming before the Congress going to be subject to a competitiveness impact analysis before it is too late, before the cows are out of the barn?"

Reorganizing the Federal Government for Science and Technology

The President's Commission did not have a main recommendation, Mr. Milbergs stated, but put forward the recommendation for a Department of Science and Technology and a Department of Trade, both to be at Cabinet-level.

Mr. Milbergs, in his statement, suggested that the Task Force carefully examine the recommendation the Commission made for the creation of a Department of Science and Technology. "Such a department, properly designed, in the next 18 months could make clear the importance of science and technology to enhance U.S. competitiveness, establish an authoritative Cabinet-level voice in government on science and technology, improve the management of Federal R&D, and effectively coordinate the development of science and technology policies in other agencies." Mr. Milbergs also suggested that the organization of the Congress with respect to science and technology programs should also be examined. He said that Congress had a very fragmented structure to deal with on science and technology issues and policies, "...which are contained in at least 2000 different R&D elements."

A Department of Trade was needed because "Trade must become a national priority and we must develop and implement a trade policy with a single, strong voice. Today, trade policy is splintered in our Executive Branch among 25 different departments and agencies", Mr. Milbergs stated.

Chairman MacKay likened the Commission's recommendation for a Department

of Science and Technology with the "black hole" phenomena in physics. "I have to say, that has been the most universally ignored recommendation of any government study I have ever seen", he commented. Chairman MacKay was interested in knowing if the Commission's recommendation for a Department of Science and Technology would still be valid, knowing now that it would be ignored.

Mr. Milbergs answered that this issue had been vigorously debated in the Commission and all members signed off on that particular recommendation. Mr. Milbergs also stated "...it seems to me that there is an opportunity to do some thoughtful work between now and the next Administration, ...in order to lay some groundwork, ...to have a proper organizational and proper management strucutre for science and technology...." He further suggested that an outside group with minimum direct stake in the outcome in the reorganization should look to see if a formulae can be found that makes some sense.

Chairman MacKay offered that if a Department of Science and Technology was not feasible "maybe we ought to be looking at some way of better rationalizing the Federal R&D establishment." He asked the participants, "Do you feel that somebody has got to really start looking at the question of restructuring the way our government is operating?"

Mr. Donley had come to the conclusion "over the years" that it is not cost-effective to pursue a Cabinet-level department, because it is too hard to change the structure of the Federal Government. However, he felt that the issue was worth re-examining. Management has a tendency to look

at the organizational structure when the corporation is in trouble, he said, and continued, "And usually that is not their problem, and it diverts attention from the main problem...."

Dr. Flax stated that the Department of Science and Technology had not been given endorsement by the Academy. This was partly due to skepticism concerning what it would accomplish, as well as skepticism that reorganization by itself could be a solution to anything. He also questioned what such a department would consist of. "Now, we believe that much of what goes on in the government that is called technology or laboratories or what have you wouldn't fit in this department anyway. You wouldn't take away from the Defense Department the R&D on cannon or aircraft or something like that for their own use. Nor would you take away from NIH their research and development in the health area, and so on." Dr. Flax also stated that technology and trade are closely linked, "So, maybe what needs to be done is to restructure the Department of Commerce. ...it is more important to understand what it is that needs to be accomplished, and that there are many solutions, ..."

Dr. Alan Rosenzweig, President of Association of American Universities (AAU) and a member of the Advisory Board, offered that there was no support for a Department of Science and Technology in university circles, particularly after the experience with the Department of Education.

Dr. Chris Hill, Senior Analyst at CRS and a member of the Advisory Board stated that a good model for what would be involved in a Department of Science and Technology does not exist. A more limited model where the

importance of science and technology is raised to a Cabinet-level concerned with the problem of mobilizing science and technology for industrial competitiveness could prove more useful, he offered.
Dr. Willenbrock, Executive Director, American Society of Engineering Education, and a member of the Advisory Board, was also not in favor of a Department of Science and Technology, which would concentrate all Federal R&D. The Office of Science and Technology Policy (OSTP) could be made a lot stronger and a lot more effective, he said. Dr. Rosenzweig agreed that OSTP must be strengthened, but that would also require a president who has the will to make it happen.

Mr. Donley thought that the President's science advisor was misnamed, "It should have been science and technology."

Congressman Ritter said that one of the problems is that there is not an appropriate representation at the highest level of government, at the Cabinet-level, by someone with the responsibility for and understanding of the importance of science and technology to the economy. "I think one of the charges for this Task Force, perhaps, should be to try to come to some kind of consensus as to how you get that voice."

The need for a stronger role for science and technology in the government was highlighted by Dr. Compton by the following example, "When a Sematech comes forward as a group of industries agreeing that they want to cooperate, asking for some government participation in this, and when the only agency in the government that can respond is the Department of Defense,

it seems to me that there is something wrong with the role that government is taking in the commercial sector. And that issue, it seems to me, is much beyond just a subsidization issue. It is a philosophy of what the government's role in the commercial sector should and can be."

Congressman Lewis, commenting on the earlier statements said, "With the political situation, ...the practical and logical approaches sometimes seem to fade away and we make more political decisions when we should make logical decisions, and I think that is a concern that I have with a science and technology department."

Chairman MacKay, drawing a parallel between the perception after World War II when there was a challenge to our national security which led to the establishment of the Department of Defense and our present economic competition stated, "I guess what is stopping us now is we are not agreed as to what the nature of the challenge that we face is, ..."

Chairman MacKay questioned whether the Federal laboratories should not undergo any peer review mechanism similar to NSF in order to improve accountability. The implication of this is that we need a better handle on where the Federal R&D dollars are going, he stated.

State and Local Government Initiatives.

Chairman MacKay said: "Maybe the greatest strength in our country is the fact that we have got all these places where innovation can take place, and we have got this tradition. ..Targeting....turns out to be the way

you do it at the State level. It is partnership." He asked the participants to discuss this, "because I think this Task Force ought to be looking at the whole question, the State and local, university, business dimension."

Mr. Milbergs stated the role of the Federal Government should be to create the proper climate, but that the initiatives for developing our own assets and our technological and human resource assets to regain our competitive edge will come from the State and local government and through
private sector initiatives, "and not from the national level here on the Beltway."

"Most of the action on competitiveness is now occurring at the State and local government level, as every region in the U.S. has to deal with the new reality of global competition. States such as Virginia, North Carolina, Massachusetts, Pennsylvania, Ohio, Georgia, Illinois, Michigan, Tennessee, New York, et cetera, have already developed new economic development strategies for technology development and transfer. The range of State programs is broad and growing, and we have a national laboratory of experiments to observe and evaluate. It is the Federal Government's interest to support these emerging initiatives,...."

Dr. Flax warned that the States have always vied with one another for industrial development, and perhaps we are taking from one another rather than facing up to the broader issues.

Congressman Ritter introduced the Ben Franklin Partnership in Pennsylvania between the State, industry and university on superconductivity. "...we are going to try to do a Pennsylvania number on superconductivity, and we know we can do it ten times as fast as anything that is going to move down here [Washington]". "Are we targeting? I guess so. ...I think targeting the process of innovation is a great idea."

Dr. Rosenzweig warned that the National Government and Congress ought to be cautious about prematurely taking actions that will foreclose the kind of experimentation that is going to take place in the States and localities.

Chairman MacKay asked Mr. Milbergs if there were a mechanism where States were talking to each other on these issues, "Are you all comparing notes? ...is there a way that people can learn more from each other's experiences about what is working best?"

Mr. Milbergs replied that most of the mechanisms were of an informal basis and that no formal mechanism existed to look at this. Some regional conferences were being sponsored by NSF, and there were some consultants that played a useful role moving ideas around among the States. "So, we are aware of what other States are doing, and for that matter, we are observing what other countries are doing in terms of trying to find ideas to push in Virginia."

Cooperation in Science and Technology Development.

Congressman Fawell questioned whether we had taken full advantage of the changes in antitrust laws which allowed for joint research. Mr. Milbergs stated that since the changes in the antitrust law passed, at least 65 industry groups have been formed. But the key, he said, is industry leadership and the willingness of industry leaders to get up and recognize the benefits in cooperation.

"It really gets down to business leadership getting their act together." He questioned the government's ability to foster such cooperation. Mr. Donley said that there is a cultural barrier in cooperating among corporations in the United States, reinforced over 30 years by the intent of the antitrust law. It will take time to change that mind-set, he stated.

Dr. Compton did not agree with Mr. Milbergs that the government does not have a role in fostering cooperation. "I think, in fact, it does have a role in, first trying to put in place a set of encouraging actions that will let the commercial sector know that it views the commercial enterprise in this country as vital to not only our economic health, but to our national security."

Dr. Willenbrock said that the university system of the United States was perhaps the strongest in the world. "How we couple that system in as to some of our current problems is a very important issue". He mentioned the engineering research centers as one such forward looking program, but

that many other ways should also be tried to couple the university capability more effectively into the industrial sector.

Dr. Flax agreed with Dr. Willenbrock. "The engineering research centers were kind of a mass movement to get something started. I would not like to see us get locked into a single approach at this stage of the game. And I think the NSF should be encouraged to allow and support more innovation in the ways and means of dealing with these problems of coupling industry to universities."

The engineering research centers dealt with a serious deficiency of engineering education, he continued. These were cross-disciplinary research centers in which universities and industries were encouraged to sponsor and conduct joint activities. The NAE also felt that engineering research, as opposed to scientific research, had been given rather too little attention in this country. "If you think of the importance of engineering in our entire economy, it is almost unbelievable that this receives so little of Federal support."

Dr. Flax also said that the NAE had been paying attention to all aspects of manufacturing. There had been a steady decline in emphasis on manufacturing education and research in the engineering universities. Part of that was the fault of industry, he said, since the universities tended to respond to what industry wants, and industry has not placed great emphasis on manufacturing. "It [manufacturing] needs attention. And probably needs continuing attention", he stated.